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The Mineral Industry of the Republic of South Africa

UNITED STATES DEPARTMENT OF THE INTERIOR

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The Mineral Industry of the Republic of South Africa

By George A. Morgan[1]

In 1987, mining and quarrying in the Republic of South Africa by about 1,000 mines and quarries accounted for $19.1 billion,[2] or about 14% of a gross domestic product of $74.2 billion, compared with 7% for agriculture, 20% for manufacturing, 11% for general government, and 8% for transportation. Crude and processed mineral exports combined accounted for about 66% of the country's total foreign earnings.

The total value of mineral sales for the Republic of South Africa was $15.2 billion in 1987, of which gold made up $8.6 billion, or 57% and coal $2.4 billion or 16%.

Total sales in the manufacturing sector were $49.2 billion, of which $3.9 billion was iron and steel; $3 billion was industrial chemicals; $1.3 billion was industrial mineral products; and $1.2 billion was nonferrous metal products.

Mining activity was primarily by six major mining houses: Anglovaal Ltd., Anglo American Corp. of South Africa Ltd. (AAC), Barlow Rand Ltd. (BRL), General Mining Union Corp. Ltd. (Gencor), Gold Fields of South Africa Ltd. (GFSA), and Johannesburg Consolidated Investment Co. Ltd. (JCI).

The South African Reserve Bank reported total gold assets of $2.5 billion as of January 31, 1988, and that its total physical holdings of gold were 6.2 million troy ounces at the end of July 1987.

Total income tax collected from gold mines for the financial year ending March 31, 1988, was $1.2 billion; for diamond the tax was $460 million. The export duty on diamond was $12 million. Rents and royalties on gold mining leases were $319 million; on diamond leases $34 million; and on other mining leases $49 million. For selected excise taxes on goods, the fuel tax garnered $528 million.

The average number of people employed on all mines and quarries during 1987 was 780,016, compared with 781,621 in 1986, and consisted of 558,337 in gold mines, 114,713 in coal mines, and 106,966 in all other mines. Total earnings by this mine labor force were $3.6 billion. Of 1,336,500 people employed in manufacturing, 124,500 were in production of metal products; 109,500 were in base metals; 80,000 were in industrial mineral products; and 91,600 were in chemical and chemical products.

In an attempt to gain greater worker participation in corporate ownership and to lessen the impact of union influence in the mining industry, AAC and Severin Mining and Development Co. Ltd. (Sevmin) announced the creation of share holding plans at little or no cost to their employees. AAC was to issue five shares in 1988 to each employee in the headquarters office who had served for 2 years. Depending upon the company's earning performance, a similar offer was to be made every year for the next 4 years. Share value to each employee was estimated at $750. AAC requested about 70 corporation affiliates to provide shares to about 250,000 qualifying employees. Sevmin was setting up a trust fund for the Eersteling Mine near Pietersburg from shares supplied by Sevmin's cofounder. Each black worker earning less than $369 per month would qualify for 100 shares paid for by the trust.

As part of the overall effort to reduce costs the mine operators sought to implement advances in processing and technology where possible, particularly to reduce labor cost, which accounted for more than 50% of total cost at some mines. Use of rubber-tired vehicles was implemented at

JCI's Randfontein and Western Areas Mines. Improved shaft sinking methods were employed to reduce shaft sinking time, which can take several years for deep, large-diameter, multicompartment shafts. The use of jumbo drills in shaft sinking can reduce labor requirements at the shaft bottom from 78 to about 15 workers. Regulations for the carrying of self-contained self-rescuers by underground workers were passed in 1986, and at yearend 1987, about 30% of underground coal miners were so equipped. The self-rescuers were expected to be introduced into gold mines in 1988.

Government Policies and Programs.—The Mines and Works Act of 1956 was amended in September to repeal the definition of "scheduled person," which originally allowed 13 job classifications requiring certificates of competency to be held only by whites and certain other groups. These classifications account for about 3% of total positions on mines and plants, and about one-third of the estimated white labor force of 70,000. These certificates, including the blasting certificate that is required for advancement to many higher positions, are now available to all qualified individuals. By yearend 1987, over 5,000 people were employed in jobs previously reserved for whites.

Bophuthatswana, with resources of asbestos, chromite, and platinum-group metals, was dissatisfied with mining contracts completed before 1977, and indicated legal action might be taken against those companies failing to explore or develop mineral rights in the region. Special tax concessions were being offered to companies that set up operations in Bophuthatswana.

Taxation policy allowed operators of new gold mines to deduct 100% of capital expenditure from mining income in the year the expenditure was incurred, and to carry forward unused balances of these expenditures. A capital allowance of 5% to 10% was allowed on normal taxation and mining lease payments.

PRODUCTION AND TRADE

The index of physical volume of all mining production, including gold, was 92.5 in 1987 compared with 100.8 in 1986 (1980=100). The index of physical volume for 1987 and 1986, respectively, of iron and steel basic industries was 101.6 compared with 104.7; of nonferrous metal basic industries, 118.3 compared with 111.6; and of industrial chemicals, 89.7 compared with 93.0.

A major strike by the National Union of Mineworkers (NUM) between August 9 and August 30 affected 33 of the Chamber of Mines 99 gold and coal mines; about 225,000 miners struck over primarily higher wage demands. Gold output for the third quarter was down about 8% at some of the struck mines, compared with the previous quarter. Cost to the miners in terms of lost wages was estimated at $5 million per day, and about 225,000 ounces of gold in ore was not mined. The National Union of Metal Workers (Numsa) was formed in May 1987 with the amalgamation of 8 trade unions, and had 80,000 members out of a total of about 340,000 in the metals sector. Numsa struck several metal plants in July, including ferroalloy and steel plants, over issues of pay and holidays, with mixed results. The union competed with 14 other unions for industry representation.

Heavy rains and flooding washed out roads and railways to the ports of Durban and Richards Bay for about a week beginning September 26. The power supply to the main coal loading terminal at Richards Bay was also cut. Loadings of coal were from stockpiled material prior to resumption of rail shipments to the port. The road link between Durban and Richards Bay, which was used for moving ships stores to Richards Bay, was also cut.

Total transport earnings were $1.2 billion in 1987, of which 9.4% was from coal, ores,

and minerals. A total of 58,903 people were employed in the sector, and earned $250 million.

Exports of coal and minerals through the port of Maputo in Mozambique were to be about 5.5 million tons by yearend 1988, partly owing to South African assistance in rehabilitating the port. The rail link from Komatipoort has been doubled to eliminate bottlenecks for shipments from the eastern Transvaal.

Exports of scrap iron and steel were controlled by the Board of Trade and Industries, which operates a licensing system whereby local scrap consumers receive preferential access to scrap at a 7.5% discount to the export price of scrap. Most consumption was by Iscor and its subsidiaries, and several iron and steel foundries. Apparent exports are listed in table 2. Owing to incomplete import statistics for 1986, the latest available import data are published in the previous edition of this chapter.

Table 1.—Republic of South Africa: Production of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1983	1984	1985	1986[p]	1987[p]
METALS					
Aluminum metal	161,300	167,357	164,600	171,575	e170,000
Antimony concentrate:					
Gross weight	10,670	12,924	12,600	11,553	e11,500
Sb content	6,302	7,440	7,390	6,816	e6,800
Beryl concentrate (11% to 12% BeO) kilograms	20,500	1,000	4,649	3,133	135
Chromite, gross weight:					
More than 48% Cr_2O_3 thousand tons	25	53	65	39	65
44% to 48% Cr_2O_3 do.	1,070	1,242	1,975	2,294	2,236
Less than 44% Cr_2O_3 do.	1,137	1,711	1,658	1,574	1,483
Total[2 3] do.	2,232	3,006	3,699	3,907	3,784
Cobalt:[e]					
Mine output, Co content	690	690	690	690	720
Metal, elemental	500	500	500	500	520
Columbium-tantalum concentrate kilograms	406	317	1	--	454
Copper:					
Mine output, Cu content	204,984	198,179	195,436	184,205	213,027
Metal:					
Smelter	192,300	178,700	191,700	r e192,000	e192,000
Refined	157,700	155,722	164,304	158,631	152,699
Gold, primary thousand troy ounces	21,847	21,861	21,524	20,513	19,228
Iron and steel:					
Ore and concentrate:					
Gross weight thousand tons	16,605	24,647	24,414	24,483	21,996
Fe content do.	10,627	15,749	15,076	15,424	13,545
Metal:					
Pig iron do.	5,213	5,455	6,574	e6,800	e6,700
Ferroalloys, blast furnace and electric-furnace:					
Ferrochromium do.	675	r867	851	870	951
Ferromanganese do.	167	r237	331	337	315
Ferrosilicochromium do.	18	27	5	e5	e27
Ferrosilicomanganese do.	131	r181	261	303	314
Ferrosilicon do.	50	r89	75	83	83
Ferrovanadium do.	e1	r(e)	(e)	1	e1
Silicon metal do.	r27	r34	36	35	34
Total[3] do.	r1,068	r1,336	1,560	1,635	1,725
Steel, crude do.	7,190	7,827	8,582	e8,800	e8,700
Semimanufactures:					
Hot-rolled products do.	NA	NA	7,005	7,189	NA
Iron castings do.	286	322	NA	NA	NA
Steel castings and forgings do.	112	111	101	91	NA
Lead:					
Mine output, Pb content	87,533	94,764	98,424	97,778	93,642
Smelter, secondary	23,600	30,794	32,836	40,463	e41,000
Manganese:					
Ore and concentrate, gross weight:					
Metallurgical:					
More than 48% Mn thousand tons	674	753	950	954	889
45% to 48% Mn do.	268	448	213	338	438
40% to 45% Mn do.	415	432	837	991	773
30% to 40% Mn do.	1,270	1,225	1,442	1,280	666
Total[3] do.	2,627	2,858	3,443	3,564	2,767

See footnotes at end of table.

Table 1.—Republic of South Africa: Production of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1983	1984	1985	1986[p]	1987[p]
METALS —Continued					
Manganese —Continued					
Chemical:					
More than 65% MnO_2 thousand tons	(*)	(*)	1	4	3
35% to 65% MnO_2 do.	98	123	118	135	117
Less than 35% MnO_2 do.	161	69	38	16	5
Total[3] do.	259	192	158	156	125
Total manganese[3] do.	2,886	3,049	3,601	3,719	2,892
Metal	23,367	36,776	31,825	[r]32,000	28,000
Nickel:[e]					
Mine output, Ni content[e]	20,500	25,000	25,000	[r]31,800	34,300
Metal, electrolytic	17,000	[r]20,500	20,000	[r]25,400	27,400
Platinum-group metals, metal content of concentrate, matte, refinery products[e 4] thousand troy ounces	2,600	3,500	3,700	3,960	4,220
Silver:					
Mine output, Ag content do.	6,513	6,997	6,700	7,145	6,691
Primary do.	1,950	2,000	2,000	2,000	1,900
Tin:					
Concentrate:					
Gross weight[e]	6,700	5,900	5,600	5,250	3,620
Sn content	2,668	2,301	2,153	2,054	1,412
Metal, primary	[r]2,685	[r]1,592	[r]2,069	[r]2,001	1,400
Titanium:[e]					
Rutile concentrate	56,000	56,000	55,000	55,000	55,000
Slag	417,300	417,300	435,000	435,000	650,000
Uranium oxide (U_3O_8)	7,128	6,762	5,744	5,460	4,735
Vanadium:					
Vanadiferous slag, gross weight	35,825	45,911	57,340	[r]68,170	[r]69,000
V content:					
Of vanadiferous slag[e]	5,100	6,500	8,085	9,600	9,700
Of V_2O_5 and vanadate products[e]	3,733	6,017	5,930	5,761	3,792
Total	8,833	12,517	14,015	15,361	13,492
Zinc:					
Concentrate:					
Gross weight[e]	200,000	200,000	190,000	200,000	220,000
Zn content	109,981	106,107	96,943	101,859	112,686
Metal, smelter	84,384	88,406	93,700	81,000	90,051
Zirconium concentrate (baddeleyite) and zircon	162,281	153,123	160,533	[r]160,000	[r]160,000
INDUSTRIAL MINERALS					
Asbestos:					
Amosite	40,656	33,237	37,856	36,009	26,026
Chrysotile	93,016	75,414	91,645	91,001	101,722
Crocidolite	87,439	58,738	34,073	11,852	20,682
Total	221,111	167,389	164,247	138,862	148,430
Barite	6,683	4,467	4,387	8,653	8,617
Cement, hydraulic thousand tons	7,897	8,188	7,034	6,712	7,256
Clays:					
Attapulgite	4,425	4,843	5,885	10,125	6,026
Bentonite	39,529	41,849	43,472	48,265	48,953
Fire clay	117,807	162,665	168,145	202,883	230,519
Flint clay	69,984	93,755	123,810	130,721	106,915
Fuller's earth	312				
Kaolin	129,605	[r]36,160	128,899	126,129	151,730
Corundum, natural	49	21	10	9	5
Diamond:					
Gem[e] thousand carats	4,554	4,516	4,550	4,473	3,631
Industrial[e] do.	5,757	5,627	5,652	5,755	5,420
Total do.	10,311	10,143	10,202	10,228	9,051
Diatomite	1,088	258	214	1,800	194
Feldspar	45,114	39,018	33,012	52,762	66,513
Fluorspar:					
Acid-grade	232,750	289,294	310,211	293,368	[r]279,000
Ceramic-grade	6,406	4,502	5,724	7,708	[r]7,000
Metallurgical-grade	28,446	25,410	33,272	32,814	[r]30,606
Total	267,602	319,206	349,207	333,885	316,606
Gem stones, semiprecious:					
Emerald crystals kilograms	575	440	102	23	
Tiger's-eye do.	120,000	111,500	178,821	257,554	400,647

See footnotes at end of table.

Table 1.—Republic of South Africa: Production of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1983	1984	1985	1986[p]	1987[p]
INDUSTRIAL MINERALS —Continued					
Gypsum, crude	518,353	535,286	458,399	404,205	349,079
Kyanite-related materials:					
Andalusite	116,576	143,305	194,693	181,466	194,373
Sillimanite	815	1,311	1,337	1,330	1,243
Lime[7] thousand tons	1,892	2,110	2,014	1,944	1,582
Magnesite, crude	22,560	33,059	28,898	61,186	74,961
Mica:					
Sheet kilograms	---	---	81	---	---
Waste	2,672	4,478	2,072	2,509	1,325
Nitrogen: N content of ammonia thousand tons	575	580	[e]580	[e]580	[e]500
Phosphate rock, gross weight do.	2,887	2,496	2,433	2,920	2,623
Pigments, mineral, natural:					
Ochers	1,319	746	528	1,340	621
Oxides	369	245	224	161	147
Total	1,688	991	752	1,501	768
Pyrites, gross weight[e]	1,500,000	875,000	900,000	940,000	890,000
Quartz, quartzite, glass sand (silica) thousand tons	1,184	1,471	1,518	1,655	1,937
Salt	744,295	615,531	722,482	752,440	703,620
Silcrete	1,839	1,153	47	---	---
Sodium sulfate	630	820	75	466	241
Stone, n.e.s.:					
Dimension:					
Granite:[7]					
Sawn slabs	11,000	13,345	11,708	10,946	17,242
Rough blocks	150,000	196,237	315,707	317,079	323,582
Marble	4,936	1,000	1,000	2,539	2,624
Slate	40,000	45,100	42,100	39,853	25,494
Crushed and broken:					
Limestone thousand tons	19,874	21,084	20,520	20,898	21,372
Shale do.	454	533	527	526	354
Sulfur:					
S content of pyrites do.	474	464	562	499	468
Byproduct:					
Of metallurgy[e] do.	125	[e]91	85	108	105
Of petroleum[e] do.	32	30	100	110	110
Total[e] do.	631	585	747	717	683
Sulfuric acid, gross weight[8] do.	3,201	NA	NA	NA	NA
Talc and related materials:					
Talc	7,617	10,561	10,220	8,641	8,005
Pyrophyllite (wonderstone)	3,575	3,851	4,227	4,606	3,467
Vermiculite	153,034	173,759	184,070	193,657	228,863
MINERAL FUELS AND RELATED MATERIALS					
Coal:					
Anthracite thousand tons	2,227	3,228	4,910	4,990	5,252
Bituminous do.	142,896	159,681	168,606	171,871	171,465
Total do.	145,123	162,909	173,516	176,861	176,717
Petroleum refinery products:					
Gasoline thousand 42-gallon barrels	38,325	37,400	37,400	[e]37,500	
Jet fuel do.	3,285	3,200	3,280	[e]3,300	
Kerosene do.	3,650	3,488	3,410	[e]3,400	
Distillate fuel oil do.	40,880	38,791	39,165	[e]39,200	NA
Residual fuel oil do.	21,900	21,312	21,645	[e]21,600	
Lubricants do.	2,555	2,625	2,520	[e]2,500	
Other do.	12,410	12,492	12,470	[e]12,500	
Refinery fuel and losses do.	6,205	[e]6,000	[e]6,000	[e]6,000	
Total do.	129,210	125,308	125,890	[e]126,000	[e]126,000

[e]Estimated. [p]Preliminary. [r]Revised. NA Not available.

[1]Table includes data available through Sept. 12, 1988.

[2]Data may not add to totals shown because of independent rounding.

[3]Excludes Bophuthatswana, which was as follows, in thousand tons: 1983—234; 1984—401; and 1986—454.

[4]Less than 1/2 unit.

[5]Reported figure.

[6]Includes osmiridium from gold ores, estimated at 2,500 troy ounces per year.

[7]Domestic sales plus exports.

[8]Sulfuric acid was produced from gases derived from local smelting operations and from burning imported elemental sulfur.

Table 2.—Republic of South Africa: Apparent exports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
METALS				
Aluminum:				
Ore and concentrate	23	451	--	France 426; West Germany 25.
Oxides and hydroxides	18	3	--	All to United Kingdom.
Ash and residue containing aluminum	264	1,126	--	Spain 790; Belgium-Luxembourg 258.
Metal including alloys:				
Scrap	9,162	7,758	184	Japan 4,237; West Germany 2,034.
Unwrought	r57,811	82,609	32,372	Taiwan 17,532; West Germany 16,028.
Semimanufactures	3,923	6,491	4,404	Japan 997; Taiwan 705.
Antimony:				
Ore and concentrate	r 31,452	3964	17	Belgium-Luxembourg 304; France 163.
Oxides	r5,120	5,410	5,342	United Kingdom 60.
Metal including alloys, all forms	--	14	--	West Germany 10; Netherlands 3.
Arsenic: Oxides and acids	113	2,307	1,210	United Kingdom 1,097.
Beryllium:				
Ore and concentrate	36	35	35	
Metal including alloys, all forms	--	1	1	
Cadmium: Metal including alloys, all forms	128	28	--	Netherlands 20; United Kingdom 8.
Chromium:				
Ore and concentrate thousand tons	r 31,415	31,009	309	Japan 380; West Germany 188; Italy 43.
Oxides and hydroxides	1,218	1,135	1,135	
Metal including alloys, all forms	--	15	--	All to United Kingdom.
Cobalt:				
Oxides and hydroxides	2	1	--	All to West Germany.
Metal including alloys, all forms	88	99	10	United Kingdom 37; Netherlands 20; West Germany 16.
Columbium and tantalum: Metal including alloys, all forms:				
Columbium (niobium)	--	2	--	All to Netherlands.
Tantalum	412	--		
Copper:				
Ore and concentrate	70,165	37,707	--	All to Japan.
Matte and speiss including cement copper	1,100	1,388	--	Greece 1,263; West Germany 125.
Oxides and hydroxides	9	6	--	All to Netherlands.
Ash and residue containing copper	2,034	--		
Metal including alloys:				
Scrap	163,094	11,941	--	West Germany 6,671; Belgium-Luxembourg 1,685.
Unwrought	154,418	141,834	10,576	West Germany 55,820; Belgium-Luxembourg 31,501; Italy 18,596.
Semimanufactures	r5,256	6,484	3,492	Hong Kong 1,740; Canada 547.
Gold:				
Ore and concentrate value, thousands	--	$371	$371	
Waste and sweepings do.	$631,585	$13	$13	
Metal including alloys, unwrought and partly wrought thousand troy ounces	r4,891	35,489	218	Italy 3,669; Japan 1,023; West Germany 514.
Iron and steel:				
Iron ore and concentrate:				
Including roasted pyrite	--	18	--	All to Switzerland.
Excluding roasted pyrite thousand tons	r 310,226	8,851	--	Japan 5,508; United Kingdom 1,222; West Germany 861.
Pyrite, roasted	37	--		
Metal:				
Scrap	r51,607	143,414	--	Japan 101,450; Taiwan 38,872.
Pig iron, cast iron, related materials	r404,873	630,003	29,887	Japan 541,387; Spain 23,653.

See footnotes at end of table.

Table 2.—Republic of South Africa: Apparent exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
METALS —Continued				
Iron and steel —Continued				
Metal —Continued				
Ferroalloys:				
Ferrochromium, all forms	[2]758,617	[2]877,971	206,129	West Germany 121,488; France 82,483.
Ferromanganese, all forms	[2]458,165	[2]529,413	132,040	Italy 24,783; United Kingdom 17,340.
Ferromolybdenum	4	2	--	All to West Germany.
Ferronickel	60	58	27	West Germany 21; United Kingdom 10.
Ferrosilicochromium	486	1,081	1,063	United Kingdom 18.
Ferrosilicomanganese	86,881	114,303	80,415	West Germany 19,995; United Kingdom 11,003.
Ferrosilicon	r [2]41,016	[2]40,069	5,177	West Germany 4,210; Belgium-Luxembourg 2,486.
Silicon metal	[2]29,067	[2]29,985	1,602	West Germany 3,003; United Kingdom 1,053.
Unspecified	r454,593	367,309	437	Japan 341,201; Canada 20,008.
Steel, primary forms	r554,169	564,727	90,552	Taiwan 114,204; Hong Kong 100,624; Greece 73,089.
Semimanufactures:				
Bars, rods, angles, shapes, sections	r441,338	611,379	101,469	Hong Kong 326,437; United Kingdom 51,117.
Universals, plates, sheets	r395,570	558,747	247,047	Japan 56,585; Hong Kong 55,641; Taiwan 51,938.
Hoop and strip	r2,137	32,499	--	Hong Kong 32,199; Greece 108.
Rails and accessories	r160	890	--	Chile 352; Belgium-Luxembourg 269; France 269.
Wire	r20,319	25,841	10,933	West Germany 3,111; Taiwan 2,588.
Tubes, pipes, fittings	r114,940	84,195	41,548	Netherlands 10,471; West Germany 7,958.
Castings and forgings, rough	r85	1,008	17	West Germany 744; Hong Kong 176.
Unspecified	--	125	125	
Lead:				
Ore and concentrate	[2]103,000	[2]102,637	--	Japan 37,469; France 37,334.
Oxides	r861	190	--	Canada 116; Chile 51.
Ash and residue containing lead	374	985	--	Belgium-Luxembourg 722; West Germany 105.
Metal including alloys:				
Scrap	698	1,311	--	Italy 497; Taiwan 377; West Germany 217.
Unwrought	37,888	17,660	--	Austria 5,550; Italy 4,739; Portugal 3,630.
Semimanufactures	81	1,457	--	West Germany 1,368; Hong Kong 79.
Lithium: Ore and concentrate	3,026	1,509	1,509	
Magnesium: Metal including alloys:				
Scrap	228	296	--	West Germany 129; United Kingdom 109; Italy 58.
Unwrought	64	--	--	
Semimanufactures	11	11	--	Netherlands 6; United Kingdom 5.
Manganese:				
Ore and concentrate, all grades thousand tons	[2]2,890	[2]2,416	28	Japan 1,018; Norway 332; West Germany 235.
Oxides	r2,610	3,691	2,911	Taiwan 476; Canada 84.
Metal including alloys, all forms	17,635	19,759	8,514	United Kingdom 3,648; West Germany 3,286.
Molybdenum:				
Ore and concentrate	86	--	--	
Metal including alloys, all forms	--	22	--	Taiwan 19; United Kingdom 2.
Nickel:				
Ore and concentrate	--	20	--	All to France.
Matte and speiss	294	29,165	--	Norway 29,014.
Ash and residue containing nickel	70	4	--	All to Netherlands.
Metal including alloys:				
Scrap	419	261	--	United Kingdom 135; Netherlands 61; Canada 34.
Unwrought	r16,422	17,615	2,482	West Germany 4,515; France 2,283; Italy 2,165.
Semimanufactures	48	782	--	Taiwan 706; France 59.

See footnotes at end of table.

Table 2.—Republic of South Africa: Apparent exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
METALS —Continued				
Platinum-group metals:				
Waste and sweepings value, thousands	$142	--		
Metals including alloys, unwrought and partly wrought:				
Palladium troy ounces	579,613	529,458	529,458	
Platinum do	1,051,007	1,176,201	1,176,201	
Rhodium do	115,485	97,706	97,706	
Iridium, osmium, ruthenium do	95,648	111,274	111,274	
Unspecified value, thousands	$329,426	$461,958	$619	Japan $239,953; West Germany $50,440; United Kingdom $38,385.
Silver:				
Ore and concentrate, Ag content thousand troy ounces	[2]7,012	[2]7,314	--	NA.
Waste and sweepings do	$3,625	$5,781	$1,315	Switzerland $2,097; United Kingdom $1,737.
Metal including alloys, unwrought and partly wrought do	[r]$24,635	$10,709	$793	United Kingdom $7,997; West Germany $1,528.
Tin:				
Ore and concentrate	3,276	1,398	--	United Kingdom 1,239; Netherlands 159.
Oxides	([3])	4	--	All to United Kingdom.
Ash and residue containing tin	305	96	--	Netherlands 53; United Kingdom 20; Belgium-Luxembourg 17.
Metal including alloys:				
Scrap	50	17	--	All to United Kingdom.
Unwrought	717	1,135	35	United Kingdom 664; Japan 175; Italy 126.
Semimanufactures	--	281	--	West Germany 280.
Titanium:				
Ore and concentrate	60,079	56,594	33,678	West Germany 5,222; France 2,844.
Oxides	761	1,760	1,549	West Germany 177.
Ash and residue containing titanium	[r]164,049	152,239	152,239	
Metal including alloys, all forms	--	13	--	All to United Kingdom.
Tungsten:				
Ash and residue containing tungsten	69	--		
Metal including alloys:				
Scrap	17	11	11	
Unspecified	86	18	--	West Germany 12; United Kingdom 6.
Uranium and thorium:				
Ore and concentrate value, thousands	$34,105	$32,139	--	All to Canada.
Oxides and other compounds	1,244	4,204	4,204	
Vanadium: V_2O_5 content of all products	[2]22,018	[2]20,728	492	NA.
Zinc:				
Ore and concentrate	[2]12,840	[2]29,510	--	NA.
Oxides	[r]25	73	--	New Zealand 52; United Kingdom 17.
Metal including alloys:				
Scrap	267	76	--	Taiwan 58; Portugal 18.
Unwrought	5,585	12,712	11,730	Taiwan 545; United Kingdom 203.
Semimanufactures	[r]117	370	67	Portugal 247; Chile 28.
Zirconium: Ore and concentrate	106,819	120,211	22,588	West Germany 26,872; Japan 18,513.
Other:				
Ores and concentrates:				
Of base metals	[r]132,829	90,993	--	Austria 44,688; Netherlands 18,218; France 10,439.
Of precious metals, n.e.s. value, thousands	$1,382	$137	$137	
Oxides and hydroxides	4,906	565	--	France 453; Spain 78.
Ashes and residues	96,841	66,064	--	Italy 64,967.
Base metals including alloys, all forms	[r]12,062	3,689	787	Japan 2,179; Norway 200.

See footnotes at end of table.

Table 2.—Republic of South Africa: Apparent exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc	(5)	37	1	Italy 36.
Dust and powder of precious and semiprecious stones including diamond value, thousands	$2,499	$393	--	West Germany $272; France $69; Ireland $24.
Grinding and polishing wheels and stones do	$15	$12	--	Canada $6; Republic of Korea $4.
Asbestos, crude	[3]143,027	[3]135,249	4,455	Japan 57,119; Taiwan 14,020; Yugoslavia 9,328.
Cement	60,222	232	209	Netherlands 20.
Clays, crude:				
Bentonite	[3]1,445	[3]1,600	--	Taiwan 1,248.
Chamotte earth	12,314	5,834	--	West Germany 4,925; United Kingdom 808.
Fire clay	1,020	NA		
Flint clay	[3]18,600	[3]14,100	--	NA.
Kaolin	[3]1,297	[3]1,600	--	Taiwan 9.
Unspecified	37,022	6,372	--	Taiwan 2,492; Austria 1,726; Canada 1,021.
Diamond:				
Gem, not set or strung value, thousands	r$1,180,346	$499,656	$356,318	Belgium-Luxembourg $96,207; Hong Kong $33,896.
Industrial stones do	r$21,170	$16,058	$194	West Germany $7,470; Japan $7,467; Spain $308.
Dust and powder do	$1,162	$387	$382	Japan $5.
Feldspar	--	[3]910	--	NA.
Fertilizer materials:				
Crude, n.e.s.	226	280	--	Switzerland 144; Japan 136.
Manufactured:				
Nitrogenous	78	24,712	--	West Germany 20,768; Denmark 2,576.
Phosphatic	r1,116	1,486	--	Denmark 1,375; Taiwan 91.
Potassic	113			
Unspecified and mixed	r70,584	33,356	40	West Germany 23,684; Netherlands 8,260.
Fluorspar	[3]283,023	[3]288,070	164,726	NA.
Graphite, natural	430	436	73	Taiwan 295; United Kingdom 54.
Gypsum and plaster	r [3]1,599	[3]663	--	NA.
Kyanite and related materials:				
Andalusite	[3]142,143	[3]113,514	--	NA.
Sillimanite	[3]1,467	[3]748	--	NA.
Unspecified	104,819	--		
Lime	--	22	22	
Magnesium compounds:				
Magnesite, crude	419	388	--	Taiwan 311; United Kingdom 72.
Other	1,285	--		
Mica:				
Crude including splittings and waste	r1,116	[6]1,065	--	United Kingdom 516; West Germany 290; Japan 206.
Worked including agglomerated splittings	--	4	--	All to United Kingdom.
Phosphates, crude	619,934	775,199	--	West Germany 257,041; Belgium-Luxembourg 255,483; Denmark 68,848.
Phosphorus, elemental	890	1,716	142	Taiwan 1,375; Belgium-Luxembourg 119.
Pigments, mineral:				
Natural, crude	[3]196	141	--	United Kingdom 101; Belgium-Luxembourg 40.
Iron oxides and hydroxides, processed	119	605	--	Taiwan 539; United Kingdom 53.
Precious and semiprecious stones other than diamond:				
Natural value, thousands	$4,783	$16,890	$2,649	Japan $7,501; Taiwan $2,617.
Synthetic do	$376	$60	--	Sweden $29; Spain $13; Italy $12.
Waste and sweepings do	$1,396	--		
Pyrite, unroasted	[3]4,149	--		
Salt and brine	[3]91,639	[3]88,761	--	Netherlands 185.
Sodium compounds, n.e.s.:				
Carbonate, manufactured	18	36	--	All to United Kingdom.
Sulfate, manufactured	r92	133	26	Canada 99.

See footnotes at end of table.

Table 2.—Republic of South Africa: Apparent exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986	Destinations, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	r387,118	333,067	--	Italy 99,426; Japan 67,136; France 56,644.
Worked	978	2,956	--	United Kingdom 1,355; West Germany 795; France 543.
Dolomite, chiefly refractory-grade	--	20	--	All to Taiwan.
Gravel and crushed rock	73,590	21	--	United Kingdom 17; Taiwan 3.
Limestone other than dimension value, thousands	$5	--	--	
Quartz and quartzite	7,186	4,049	--	United Kingdom 3,575; Taiwan 239.
Sand other than metal-bearing	r25,592	18,785	--	Belgium-Luxembourg 15,782; West Germany 1,988.
Sulfur: Elemental, all forms	[2]4,149	--	--	
Talc, steatite, soapstone, pyrophyllite	303	541	--	West Germany 505; Ireland 18; Sweden 18.
Vermiculite	[2]164,287	[2]190,593	--	France 21,744; West Germany 2,658; Italy 7,722.
Other:				
Crude	r118,438	133,988	--	United Kingdom 39,389; France 21,923; West Germany 16,974.
Slag and dross, not metal-bearing	11,848	89,760	--	Japan 74,857; United Kingdom 14,903.
MINERAL FUELS AND RELATED MATERIALS				
Carbon black	r6,256	16,789	--	Taiwan 16,760.
Coal:				
Anthracite and bituminous thousand tons	[2]44,909	[2]45,486	934	Japan 8,835; Italy 5,451; Spain 4,079.
Briquets of anthracite and bituminous coal	71,194	120,987	--	Italy 120,912.
Lignite including briquets	r55,954	25	--	All to Ireland.
Coke and semicoke	261,687	160,622	--	West Germany 77,443; Belgium-Luxembourg 60,964.
Petroleum:				
Crude thousand 42-gallon barrels	96,416	12,025	--	Canada 9,907; Taiwan 1,935.
Refinery products:				
Liquefied petroleum gas do	52	32	--	All to Italy.
Gasoline do	--	1,249	716	Japan 533.
Mineral jelly and wax do	203	[7]234	96	West Germany 59; Japan 22.
Kerosene and jet fuel do	22	388	247	Japan 141.
Distillate fuel oil do	123	521	--	All to Spain.
Lubricants do	6	3	(8)	West Germany 1; Taiwan 1.
Residual fuel oil do	1,173	296	--	Canada 189; Japan 95.
Bitumen and other residues do	47	--	--	
Petroleum coke do	(8)	136	--	Italy 116; Belgium-Luxembourg 16.

rRevised. NA Not available.

[1]Table prepared by Virginia A. Woodson. Because official South African trade statistics provide data only on the value of total exports of each commodity class (with no data on destinations) and not on quantity of material exported, this table has been compiled from a variety of sources including the data issued by the Department of Mineral and Energy Affairs and official trade returns of trading partner countries. Data issued by the Government of the Republic of South Africa are footnoted; other figures are compiled from a variety of sources with specifics on destination obtained from the import statistics of the trading partners. Data presented are exports by the common customs area of Botswana, Lesotho, the Republic of South Africa, and Swaziland. Comparable import data for 1986 were not available at the time of publication.

[2]Data issued by the Government of the Republic of South Africa.

[3]Excludes unreported quantity valued at $329,000 imported by Sweden.

[4]Unreported quantity valued at $351,000.

[5]Unreported quantity valued at $3,000.

[6]Excludes unreported quantity valued at $29,000 imported by Japan.

[7]Excludes unreported quantity valued at $61,000 imported by New Zealand.

[8]Less than 1/2 unit.

Table 3.—Republic of South Africa: Value of domestic sales and exports of major mineral commodities

(Thousand U.S. dollars)

Commodity	Domestic sales			Exports		
	1985	1986	1987[p]	1985	1986	1987[p]
METALS						
Antimony	7,741	NA	NA	2,820	NA	NA
Chromite	41,199	51,428	68,502	67,085	43,508	65,974
Copper	98,788	109,392	121,905	152,724	138,849	198,717
Gold	[1]	[1]	[1]	6,978,847	7,618,477	8,628,625
Iron ore	69,814	76,747	99,761	145,708	132,067	181,845
Lead concentrate	--	--	--	21,731	25,459	37,256
Manganese	25,049	30,051	29,875	111,305	89,504	57,077
Nickel	33,501	20,999	45,383	37,765	29,770	75,351
Silver	647	1,763	1,428	33,588	30,845	35,225
Tin	10,876	6,331	7,560	11,568	7,069	3,779
Titanium	13,133	[e]14,000	NA	19,470	[e]22,000	NA
Uranium[e]	NA	NA	NA	200,000	150,000	NA
Vanadium	[e]3,500	[e]3,800	NA	[e]60,000	[e]65,000	NA
Zinc	29,859	23,280	46,431	5,442	10,593	5,477
Zirconium	340	NA	NA	29,369	[e]30,000	NA
INDUSTRIAL MINERALS						
Asbestos	1,715	2,116	3,550	44,973	41,547	49,327
Cement[e]	350,000	[r]275,000	NA	35,000	30,000	NA
Clays:						
Flint	4,446	2,294	3,613	1,372	1,069	1,156
Other	4,859	6,447	8,441	106	120	48
Diamond	[1]	[1]	[1]	353,557	465,501	NA
Feldspar	1,888	2,440	3,167	--	75	334
Fluorspar	2,062	2,466	4,539	23,734	24,872	26,634
Granite	1,003	1,326	3,588	15,947	20,546	34,502
Gypsum	3,053	3,167	3,487	8	4	--
Kyanite-related materials:						
Andalusite	4,398	6,242	6,120	11,411	9,823	13,024
Sillimanite	17	46	6	134	80	170
Lime products	56,545		101,757	2,283		2,499
Limestone	34,345			78		
Magnesite	1,002	1,957	2,239	--	--	--
Mica	213	278	362	303	257	547
Phosphate rock	37,714	[e]35,000	NA	16,532	[e]15,000	NA
Pyrite-sulfur	19,097	26,064	NA	89	--	--
Salt	17,168	18,833	21,158	2,018	2,253	2,217
Silica, sand	10,881	12,967	18,169	28	17	23
Slate	1,047	1,118	711	2,575	2,928	1,395
Stone, other	1,090	1,203	4,964	137	267	48
Vermiculite	261	250	282	12,630	15,095	15,367
Wonderstone	521	98	222	--	--	--
Miscellaneous	197,326	90,569	503,712	791,513	1,187,380	2,266,838
MINERAL FUELS						
Coal:						
Anthracite	14,394	12,681	16,267	129,455	132,472	88,312
Bituminous	861,070	958,388	1,227,270	1,302,949	1,259,245	1,026,410
Total	1,949,762	1,901,098	2,384,960	10,624,324	11,088,687	12,769,253

[e]Estimated. [p]Preliminary. [r]Revised. NA Not available.
[1]Value, if any, is included under exports.

Sources: Republic of South Africa Department of Mineral and Energy Affairs, South Africa's Mineral Industry 1986; Minerals Bureau, Mineral Production and Sales Statistics, 1986 and 1987.

COMMODITY REVIEW

METALS

Aluminum.—Alusaf (Pty.) Ltd., the sole producer of aluminum and 66% owned by the Industrial Development Corp., was again mentioned for possible privatization by the Government. A method to market the shares and the extent of continuing Government ownership in the company was yet to be decided. Alusaf exported about 50% of its annual output of about 170,000 tons of aluminum metal.

Antimony.—Consolidated Murchison Ltd.'s antimony and gold output was adversely affected by a NUM strike in August and September, which lasted for 18 days.

Production losses included 500 tons of antimony concentrate and 640 ounces of gold. Gold head grade also declined until December owing to a change in mining areas. Output from the Monarch East shaft at yearend had higher gold content, reversing the declining trend. Although primarily an antimony producer, the company was exploring for gold in the Murchison greenstone belt.

Chromite.—Chromite output by South African Manganese Amcor Ltd. (Samancor), was through its 51%-owned Cromore Ltd. from seven mines. Cromore Ltd. reactivated the Jagdlust Mine following a period of care and maintenance after its purchase from Union Carbide Corp. in 1986. Samancor accounted for about 50% of total chromite exports. About 65% of total chromite output by Samancor was for production of high-carbon ferrochromium and intermediate-charge ferrochromium at its ferroalloy plants.

The Chroombronne Mine at Kroondal was owned by Erts Handel (Pty.) Ltd., 50%, and Chromecorp Technology, 50%. Production capacity was to increase to about 250,000 tons per year from 100,000 tons per year. The labor force was 250. Output was slated for a new charge chrome smelter near Rustenburg.

Copper.—Lower concentrate grades and underutilized refinery capacity has caused Palabora Mining Co. (PMC) to increase output by 19% to about 140,250 tons of cathode per year. The increase was part of a $6 million expansion project that included modification of the reverberatory furnace and increased throughput of concentrates to the smelter. PMC expanded ore output by decreasing the waste-to-ore ratio of its in-pit mining operation as it proceeded toward termination of open pit mining and commissioning of an in-pit crusher and conveyor system in mid-1988.

Gold.—The average grade of gold mined was lowered to 0.170 troy ounce per ton from 0.181 ounce per ton owing to an 8% increase in the price of gold in 1987. Total ore milled was 107.6 million tons.

Total working revenue of the gold mines, which were members of the Chamber of Mines, was $7.77 billion, or $78.81 per ton of ore milled, equivalent to $464.26 per ounce of gold recovered. The average production cost per ton of ore milled was $46.63, equivalent to $274.65 per ounce produced. An average working profit of $32.17 per ton of ore milled was realized, or $189.49 per ounce of gold recovered.

Nearly 150 exploratory drilling rigs were operational in the Witwatersrand Basin at a cost of about $147 million. Exploration was concentrated on the Potchefstroom area, where gold-bearing formations were at depths of about 4,000 meters. A borehole in the Mooi River area intersected the Bird Reef at 3,184 meters, and assayed 0.68 ounce per ton over a thickness of 83 centimeters. Although grades appear comparable with currently mined ores, western portions of the Witwatersrand Basin are extensively faulted, resulting in difficult mining conditions. Rhombus Exploration Co. intersected rock identified as being part of the lower Witwatersrand group at 2,200 meters depth. The area is 100 kilometers south of the closest gold mine in the basin, Beatrix Mine, and could substantiate the theory that the new area is part of the Witwatersrand gold-bearing basin. It represents a major new gold mining area with potentially large reserves. Capital expenditure by existing and new gold producers was estimated at $1.5 billion.

Reclamation of sand and slime accumulations from the Witwatersrand Goldfields continued, and the total gold resource available in these accumulations was estimated at 42 million ounces. Sand dumps in the Central and West Rand areas contained about 0.022 ounce per ton, and slimes dams in the East Rand were estimated to contain 0.026 ounce per ton.

Sevmin, which took over 14 mining projects covering various minerals from Utah International Co. (formerly Utah Mining Co.) of the United States, commenced reopening of the Eersteling gold mine near Pietersburg, well outside the Witwatersrand Basin. Shaft sinking to a total depth of 300 meters commenced in early 1987 and the first gold output was expected in 1988. Output would be 10,000 tons of ore per month. Reserves were about 2.4 million tons and average recovery grade was estimated at 0.16 ounce of gold per ton. Recovery would be by the carbon-in-pulp process and total project cost was $10 million.

Table 4.—Republic of South Africa: Gold production and ore reserves, by producer

Producer	Production (troy ounces)				Developed ore	
	1984	1985	1986	1987[p]	Thousand metric tons	Troy ounces per ton
AAC Joint Metallurgical Scheme	129,066	121,777	88,199	87,842	NA	NA
Barberton	56,521	55,945	53,740	55,331	NA	NA
Blyvooruitzicht	501,381	426,084	425,617	383,069	1,948	0.463
Bracken	110,042	122,333	98,703	84,878	1,120	.190
Buffelsfontein:						
Buffelsfontein section	1,011,519	1,230,771	1,128,888	549,285	7,897	.322
Beatrix section	--	--	--	395,293	3,610	.248
Consolidated Murchison Ltd	25,302	[e]27,000	26,942	[e]25,000	NA	NA
Deelkraal	234,642	231,032	243,947	264,475	4,754	.209
Doornfontein	314,906	306,528	278,464	259,276	6,211	.240
Driefontein Consolidated Ltd.:						
East Driefontein	1,110,646	914,205	888,321	1,060,790	8,141	.519
West Driefontein	1,238,930	1,157,435	1,033,182	1,053,257	7,962	.470
Durban Deep	244,734	242,645	239,790	231,389	4,163	.135
East Rand Gold and Uranium Co. Ltd. (Ergo)	207,694	222,965	280,386	254,601	NA	NA
East Rand Proprietary Mine	335,017	329,590	296,539	284,241	11,225	.190
Elandsrand	343,813	378,430	380,536	351,031	4,457	.325
Free State Geduld	860,009	857,626	[1]	[1]	[1]	[1]
Freegold:						
North region	[1]	[1]	1,715,719	1,523,879	18,620	.364
South region	[2]	[2]	1,707,974	1,629,809	25,949	.306
Grootvlei	247,445	220,342	184,384	145,990	1,390	.213
Harmony	1,037,310	1,057,147	923,690	894,915	27,226	.169
Hartebeestfontein	996,778	926,921	993,855	1,015,769	17,597	.392
Kinross	432,748	473,474	397,238	381,211	7,280	.286
Kloof	1,048,190	1 901,173	927,258	969,344	5,663	.694
Leslie	148,170	125,507	112,302	105,294	920	.238
Libanon	285,440	282,116	287,157	273,660	5,112	.191
Loraine	278,271	286,604	280,804	262,221	11,114	.228
Marievale	38,790	36,533	32,344	26,743	430	.178
President Brand	726,580	670,869	[2]	[2]	[2]	[2]
President Steyn	783,615	738,752	[2]	[2]	[2]	[2]
Randfontein	998,781	1,035,606	869,966	761,554	13,541	.188
St. Helena	396,843	397,441	313,244	285,530	6,390	.326
St. Helena-Beisa	40,526					
Stilfontein	346,623	319,215	275,072	231,482	3,215	.294
Unisel	291,385	298,391	302,442	241,870	3,650	.260
Vaal Reefs	2,659,969	2,615,636	2,620,327	2,337,700	31,046	.401
Venterspost	203,315	188,844	189,782	21,884	7,459	.174
Western Areas	567,878	527,657	516,790	410,211	6,692	.170
Western Deep Levels	1,158,907	1,204,613	1,196,009	1,102,647	7,190	.601
Western Holdings	1,252,472	1,244,062	[1]	[1]	[1]	[1]
West Rand Consolidated	140,142	130,457	125,163	127,458	4,051	.231
Winkelhaak	471,709	445,956	442,419	383,494	9,450	.280
Witwatersrand Nigel	25,984	26,171	40,510	[e]40,000	NA	NA
Other	558,828	687,377	592,146	535,194	NA	NA
Total or average	21,860,921	21,565,230	20,513,665	19,227,887	275,473	.297

[e]Estimated. [p]Preliminary. NA Not available.
[1]Free State Geduld and Western Holdings are included with Freegold, north region, commencing in 1986.
[2]President Brand and President Steyn are included with Freegold, south region, commencing in 1986.

Sources: Chamber of Mines of South Africa, Quarterly Analysis of Working Results, Oct.-Dec. 1982-87; supplements to the Mining Journal (London), 1982-87. Consolidated Murchison Ltd. Annual Reports 1982-85.

The Springs Dagga and Consolidated Modderfontein gold mines, with a 5.5 kilometer-long common boundary, were merged in April under the management of Golden Dumps Ltd. The company also acquired the Langlaagte Mine with a reported mine life of 30 years, and commenced construction of a 6,000-ton-per-month carbon-in-pulp plant. Reserves were 21 million tons of ore in three horizons and the grade was 0.113 ounce per ton. About 12 to 14 million tons of potentially minable waste dumps existed at the surface.

AAC's Western Deep Mine, a major gold producer, suffered serious damage at several stoping levels during the strike by NUM owing to uncontrolled rock pressure. Production startup in these stopes was delayed several months.

A number of new or rejuvenated gold mines were under way outside the Witwatersrand Basin. AAC and BRL commenced development of the Barbrook Mine in the Barberton gold mining area, each having 50% of the operating company, Barbrook Mines Ltd., at a cost of $47 million. Reserves

were 14.9 million tons averaging 0.23 ounce per ton in situ and 0.14 ounce per ton recovered. Output would be 25,000 tons per month with commissioning scheduled for late 1989 and full production by 1990. Recovery would be by roasting the refractory ore, cyanidation, and carbon loading of gold in the leachate.

Also in the Barberton area, Gencor commenced a full-scale bacterial leach plant at the Fairview Mine. *Thiobacillus ferrooxidans* was used to treat 300 tons of concentrate per month containing refractory minerals, converting pyrite and arsenopyrite to sulfuric acid and iron sulfate. Yield was 3.22 to 4.82 ounces per ton at 95% recovery, compared with 90% recovery for roasting and acid leaching. Capital expenditures were put at 60% of the $3.2 million required for a modern roaster.

Gencor also commenced opening of the Oryx Mine, a major large mine, on the closed Beisa uranium mine property for about $0.74 billion. Gencor owned 55%, and Genbel Investments 10% of the mine; the remainder was held by African Selection Trust, a subsidiary of British Petroleum Minerals Corp., and AAC. Use of the existing shaft system and infrastructure of the Beisa Mine would save about $49 million. The mine shafts at Beisa Mine, which extend to 1,070 meter depth in the main shaft, were to be dewatered and ore production would commence from the Beisa Reef at 15,000 tons per month starting in July 1988. Subvertical shafts would be sunk to 2,400 meters depth to access the Kalkoenkrans Reef. A phased increase to 100,000 tons per month was expected, with a target output of 220,000 tons per month planned in 1994 from the commissioning of a second shaft system from the surface. Total employment would be about 7,000. Ore reserves were estimated at 52 million tons grading 0.29 ounce in situ and 0.25 ounce recovered.

JCI completed mechanization programs at its Randfontein and Western Areas Mines. About 50% and 70%, respectively, of ore output by these mines was now from trackless mining. Strikes and work stoppages occurred at the mines during implementation of the programs as a number of workers were retrenched.

Iron and Steel.—The Iron and Steel Corp. of South Africa Ltd. (Iscor), expected its new direct-reduction plant near Pretoria to come on-stream in early 1988, using steam coal from the Transvaal instead of coking coal, which was in short supply. Iscor successfully researched and developed new technology for the utilization of noncoking coals in iron ore reduction in place of coke. Iscor's Vanderbijlpark steelworks was struck by 6,500 members of Numsa in July over wage rates. Contingency plans to ensure against disruption in output were put into effect, and there were no reports of production losses.

Middleburg Steel and Alloys (Pty.) Ltd. (MSA) planned to expand its stainless steel production capacity at Krugersdorp as part of a $79 million program over the next 2 years. Production was about 100,000 tons per year with nearly 50% sold domestically. MSA's 3CR12-grade stainless steel gained wider acceptance with the development of a compact, portable, compressed air-plasma cutter. The steel and the cutter were being used by the President Steyn Mine for all its ore cars.

Highveld Steel and Vanadium Corp. commissioned a new 63-megavolt ampere (MV•A) submerged-arc furnace at its No. 2 ironmaking plant. The furnace was supplied and commissioned by Mannesmann Demag AG, and was expected to produce 600 tons per day of pig iron. After prereduction of the ore at 1,000° C, the furnace is charged automatically with iron ore and is computer controlled.

Ferroalloys.—The Meyerton plant of Metalloys Ltd., 100% controlled by Samancor, increased production of ferrosilicomanganese by reducing ferromanganese output, which faced a declining market. Metalloys Ltd. dismissed 1,100 workers or about 65% of its labor force in early August because of illegal strike action by NUM. The strike was in sympathy with other strikes nationwide. The Meyerton plant had an annual capacity to produce about 500,000 tons of ferromanganese or 300,000 tons of ferrosilicomanganese, and about 15,000 tons of ferrosilicon. The impact on output by the strike was not known.

Heavy worldwide demand for stainless steel resulted in near full capacity utilization for production of ferrochrome at about 1 million tons per year. Chromecorp Technology was building a 120,000-ton-per-year, $26 million ferrochrome smelter near Rustenburg. Two 30-MV•A ampere submerged-arc furnaces would be used. Chromite for the smelter was to come from the Chroombronne Mine 18 kilometers distant.

MSA continued to expand its ferrochrome and stainless steel plants. Its plasma arc

furnace at Krugersdorp was to be upgraded from 16 MV•A to 40 MV•A, allowing production of an additional 30,000 tons to 45,000 tons per year of ferrochrome from chromite fines.

Ferrometals (Pty.) Ltd., also 100% controlled by Samancor, operated at full capacity, employing 1,000 workers on three 8-hour shifts, 7 days per week, owing to strong demand for ferrochromium in the first quarter of 1987. Its new intermediate-charge ferrochrome converter operated at its full rated capacity of 50,000 tons per year. Due to the high cost of electricity at 30% of plant costs, Ferrometals was investigating the use of a Krupp direct-reduction process. Options were refitting of its No. 2 or No. 3 furnaces at a cost of about $6 million or building a new unit costing about $22 million. Ferrometals held 49% of Tubatse Ferrochrome (Pty.) Ltd., which also produced charge chrome. Nearly all charge chrome output by Ferrometals, Crometals (Pty.) Ltd., and Tubatse was exported. Ferrometals also produced 75% ferrosilicon at its Witbank plant and 15% ferrosilicon at its Meyerton plant. Both products were sold domestically and overseas. Its 15% ferrosilicon was used as heavy medium in the recovery of diamonds, iron ore, and uranium.

Samancor had a 10-year contract to market ferrochromium produced at the Batlhako plant in Bophuthatswana. Output was 60 tons per day from a single 12.5-MV•A submerged-arc furnace, and was shipped to Samancor's Ferrometals plant at Witbank for crushing and sizing prior to export to Taiwan via the ports of Richards Bay or Durban. Feed material of about 4,000 tons per month of chromite was from Samancor's wholly owned subsidiary Batlhako Mining Ltd., which operated the Ruighoek Mine, also in Bophuthatswana. Metallurgical coke was from the Hlobane Colliery in Natal, supplemented by low phosphorus coal. The total labor force was 103 people.

Magnesium.—All magnesium requirements were met through imports and amounted to 1,089 tons for 1986, the latest year available. Work commenced on a demonstration plant to produce magnesium from domestic ore using transferred arc technology. A 100-kilowatt furnace would have a daily throughput of about 500 kilograms of raw material to yield 50 kilograms of metal. Satisfactory results were obtained from a pilot plant in August 1985. Total import savings were estimated at about $5 million, with the potential for export of excess product.

Manganese.—The Manganese Metal Co. (Pty.) Ltd. (MMC) operated two manganese metal plants at Krugersdorp and Nelspruit with a total capacity of 40,000 tons per year using a hydrometallurgical process. Powdered manganese ore was reduced in a rotary kiln and leached in recycled acid. Following solution clarification and precipitation of deleterious metals, electrolysis produced high-purity manganese metal. After 20 hours of deposition, cathodes were stripped of manganese metal by hand using a rubber mallet. Degassing of the flakes occurred in a rotary kiln, and the final product was sized and packed in 500-kilogram drums.

Samancor's manganese mines in northern Cape Province operated well below their capacity of 4.5 million tons per year in the first quarter of 1987 owing to reduced demand for lumpy ore. The opencast Mamatwan Mine operated at 50% capacity, producing about 65,000 tons per week of 37% to 38% manganese ore in both fine and lumpy form. Overburden was 45 meters and the stripping ratio was 2:1. Proved reserves were 5.6 billion tons and probable reserves were 13.6 billion tons. About 500,000 tons per year was exported and the remainder was shipped to Samancor's Metalloys Ltd.'s plant at Meyerton for blending with Wessels Mine ore in the ratio of 70:30 for the production of ferromanganese. Work on a $30 million sinter plant continued and was planned for completion in 1988. Sintered ore will replace lumpy ore at the Meyerton plant, thereby reducing electricity and carbon reductant needs, as well as transport mileage. A heavy-medium separation plant costing $2.5 million was also planned to improve shipment grades. Current railroad transport charges to Port Elizabeth from northern Cape Province were $15 per ton of ore.

The underground Wessels Mine was accessed via a vertical shaft and two incline shafts to a depth of 370 meters. Mining was by room-and-pillar method using trackless equipment, and production capacity was 1.2 million tons per year. Scoop loaders discharged blasted ore into 30-ton haulers, which transported the ore to four underground primary crushers. Conveyers with a capacity of 700 tons per hour moved primary crushed ore to underground secondary crushers and finally to underground

storage silos. Ore from the Wessels Mine graded up to 60% manganese owing to hydrothermal alteration from structural deformation, and mine life was estimated at 70 years. A pilot plant to sort specific grades of ore using X-ray fluorescence was operating at the rate of 30 tons per hour. Output of 200 tons per hour was required for a commercial operation.

The Hotazel Mine neared the end of its reserves and output was about 7,000 tons per month grading more than 50% manganese.

Platinum-Group Metals (PGM).—Rhombus Mining and Exploration Co. Ltd., which holds leases in the Bushveld Igneous Complex, location of the country's principal reserves, was listed on the Johannesburg Stock Exchange for the first time. Capital obtained through both private and public listing of company shares was to be used primarily for its PGM prospect in northern Transvaal. The company was in litigation with the Government over Messina Ltd.'s acquisition of the same prospect for development.

Total revenue for Rustenburg Platinum Holdings (RPH) was $1.08 billion in the year ended June 30, 1987. RPH concluded an agreement with the Lebowa Development Corp. (LDC) to exploit PGM resources located in Lebowa, site of a portion of the northeastern limb of the Bushveld Complex. LDC obtained 7.5% of the share capital of Atok Mine, which was to be listed on the Johannesburg Stock Exchange as Lebowa Platinum Mines (LPM). Output would be 50,000 tons of ore per month from the Merensky Reef and 10,000 tons per month from the UG2 chromitite horizon. LPM also had an option to exploit the Maandagshoek deposit, commencing at 50,000 tons of ore per month. Expansion to 100,000 tons per month within 5 years would allow LPM access to additional reserves. Successful development of these deposits would result in recovery of about 300,000 troy ounces of PGM per year, and allow RPH access to the Plat Reef in Lebowa for development of additional PGM resources.

Matthey Rustenburg Refinery Ltd. relocated its refinery to Bophuthatswana from Wadeville.

Golden Dumps Ltd. continued work on the Lefkochrysos Mine near Brits through Lefkochrysos Platinum Ltd., following JCI's loss of mineral rights to the deposit owing to its nondevelopment of the site. Revised development plans included startup at year-end 1988, primarily from the UG2 ore horizon, and output of about 160,000 tons of ore per month and 300,000 ounces of PGM per year. PGM composition was expected to be 50% platinum, 25% palladium, 9% to 10% rhodium, and about 15% minor PGM. Reserves were 125 million tons grading 0.19 ounce per ton. Mine and plant costs were estimated at $100 million.

Northam Platinum Ltd. continued development of its major new underground PGM mine in the western limb of the Bushveld Complex, sinking its No. 1 and No. 2 shafts to 262 meters and 517 meters below collar, respectively.

BRL formed Barplats Investments Ltd. to hold the joint platinum interests in Rhodium Reefs and Vansa. Barplats will own the entire share capital of Rhodium Reefs, which was developing a platinum deposit below the vanadium-magnetite deposit of Vansa at Kennedy's Vale near Steelpoort.

Silicon.—The sole production of silicon metal in Africa was by Silicon Smelters Ltd. High-quality quartz was mined at Pietersburg in the northern Transvaal and converted to silicon metal at nearby Silicon Smelters Ltd. The smelter operated at full capacity, and nearly all output was exported for use in the manufacture of aluminum and silicone.

Titanium.—Rhombus Mining neared completion of assessment of titanium sand deposits about 20 kilometers north of the mouth of the Kei River in the Transkei region. Planned annual production capacity was 300,000 tons of ilmenite, 25,000 tons of rutile, and 30,000 tons of zircon. Reserves were estimated at 250 million tons containing 6% heavy minerals, of which 5.2% was ilmenite, 0.4% rutile, and 0.5% zircon. Sevmin announced that it may commence production of ilmenite, rutile, and zircon in the Mtunzini area, Natal Province. A decision to proceed with a small-scale operation was to be made in March 1988.

Vanadium.—Total exports of vanadium were reported at $94.6 million. The first stage of the $25 million vanadium project at Kennedy's Vale for Vansa Vanadium Ltd., consisting of massive foundations for a rotary kiln, plant, workshop, and storage buildings valued at $1.5 million was completed. Initial mine output was planned for early 1988.

Zinc.—The Pering Mine of Shell South Africa Ltd. reached its target production rate of 1.1 million tons of ore milled per year, yielding 60,500 tons of zinc concen-

trate grading 55% zinc, and 9,000 tons of lead concentrate grading 65% to 68% lead. Reserves were estimated at 18.4 million tons grading 3.60% zinc and 0.64% lead. Demonstrated reserves were 23.4 million tons averaging 1.13% zinc and 0.28% lead. The deposit was mined as an open pit, and several grades of rock were mined and stockpiled for possible future processing. Recovery rates of mill feed were expected to be 92% for zinc and 86% for lead. All lead concentrate sales were under contract for a 3-year period to the Tsumeb smelter in Namibia, a rail journey of 1,600 kilometers. Prices for zinc were based on European producer prices and for lead on the London Metal Exchange. The labor force was 215 people with a monthly wage cost of $157,200. Electric power costs were about $100,000 per month; mining costs were about $6.19 per ton, and transport costs about $1.08 per ton.

Zirconium.—Palabora Mining Co. Ltd. produced 7,124 tons of baddeleyite in 1987 compared with 11,522 tons in 1986 owing to unplanned maintenance. Low-grade feedstocks from the commissioning of a new copper cleanup unit also adversely affected output. The unit was a copper flotation column designed to remove additional copper contamination from crude zircon concentrates; it resulted in the recovery of 180 tons of copper sulfide. Output of zirconium oxide for coloring in ceramics was 785 tons, compared with 851 tons in 1986. The acid-zirconium-sulfate-tetrahydrate (AZST) plant produced 1,530 tons of product. Baddeleyite and AZST were not used domestically; however, about 1,000 tons of premium-grade material and 4,000 tons of standard-grade material were consumed locally.

INDUSTRIAL MINERALS

Cement.—Production continued to be well below capacity owing to low demand domestically and the high cost of transport for export shipments. Sinter production capacity was 11.16 million tons and cement production capacity was 12.02 million tons.

Diamond.—Total marine diamond output, including that from offshore Possession Island, was 66,875.4 carats, compared with 45,964.3 carats in 1986 and 54,618.1 carats in 1985. Mining early in the year was adversely affected by an abnormally virile plankton population that obscured visibility. Marine West Corp. (Mervest), which operated out of Port Nolloth to its offshore diamond-mining areas, had a total of 13 vessels in its exploitation program. Gravel pumped aboard were bagged for processing ashore. As the company's properties were no longer concessions with a 5% royalty due, but actual mining areas, Marine West had to pay 25% of profits to the government before payment of the company tax, which was 58%. Approximately 70% of earnings was paid to the Government.

An additional 13 marine diamond concessions were allocated off the west coast of the Republic of South Africa, and 14 companies or individuals continued to work concessions that were issued in 1983 and 1984. Five shore-based concerns were also working marine areas.

Table 5.—Republic of South Africa: Marketed diamond output, by Province

Province	1985		1986		1987[p]	
	Output (carats)	Price per carat	Output (carats)	Price per carat	Output (carats)	Price per carat
Mine diamond:						
Transvaal	2,700,601	$22.45	2,884,380	$24.07	2,491,283	NA
Cape Province	6,147,626	30.27	6,077,429	34.84	5,172,524	NA
Orange Free State	68,143	64.73	31,929	94.67	22,204	NA
Total or average	8,916,369	28.34	8,993,738	31.60	7,686,011	NA
Alluvial diamond:						
Transvaal	52,617	161.78	47,422	178.71	36,411	NA
Cape Province	1,232,406	94.63	1,186,042	122.04	1,327,441	NA
Orange Free State	1,079	359.50	2,130	500.15	992	NA
Total or average	1,286,102	97.85	[1]1,235,593	124.87	1,364,844	NA
Grand total	10,202,471	36.75	10,229,331	42.87	9,050,855	NA

[p]Preliminary. NA Not available.
[1]Data do not add to total shown because of independent rounding.

Sources: Minerals Bureau, Mineral Production and Sales Statistics, 1985, 1986, and 1987. R1 = $0.4564 for 1985, R1 = $0.4408 for 1986, and R1 = $0.4856 for 1987.

The Department of Mineral and Energy Affairs announced commercial startup of an alluvial diamond mine near Lichtenburg in western Transvaal. Development would be by Shenandoah (Pty.). Throughput to rotary pans would be 900 tons per day at full production. Infrastructure and mine development have been under way for 2 years.

Frigate Mining Co. commenced strip mining at the Klipdam Mine near Kimberley. Output was not reported but reserves were expected to last 5 years. The company also had interests in coal and gold.

Dolomite.—Output was by Lyttelton Dolomite Ltd., a subsidiary of Samancor, at its Verwoerdburg deposit in the Transvaal. Near full capacity was reached with sales of stone products to the metallurgical and construction industries, and powder for rockdust to the coal-mining sector. A dolomite deposit was acquired at Irene, south of Verwoerdburg, and remained to be exploited.

Fertilizer Materials.—Langfos and langfos mixtures were produced at Langebaan in western Cape Province. Expenditures by Samancor totaled $750,000 for the construction of a mixing plant at Driemanskap in the Transvaal to produce langfos mixtures.

Granite.—Kudu Granite Co., near Rustenburg, expanded marketing of black and grey granite mined from the eastern and western limbs, respectively, of the Bushveld Complex. Shipments were via Durban to ports in Europe and Asia, and were valued at $1.5 million.

Keeley Granite Co. was expanding output of black granite to more than 50,000 tons per year. About 20 quarries were worked for the premium quality black granite in the Belfast area in the eastern Transvaal. The company signed a $12 million, 12-month-delivery contract for the supply of 60,000 tons of various granite types for shipment to Europe. Red granite from two quarries near Potgietersrus was shipped to the Far East. About 90% of the company's total annual output of nearly 200,000 tons was exported to about 20 countries.

Gypsum.—Pretoria Portland Cement Ltd.'s (PPC) synthetic gypsum plant at its Jupiter cement works used sulfuric acid derived from Zinc Corp. of South Africa Ltd.'s operation and locally produced limestone supplied from PPC's slurry plant near Mafikeng. The limestone was fine ground and dissolved in 70% sulfuric acid in a paddle mixer. The resulting magnesium sulfate, carrying only traces of acid, was transferred by conveyor to a storage area for a curing period of 3 days. Neutralization and water absorption resulted in gypsum crystals for use in cement manufacture.

Phosphate Rock.—Yellow phosphorus and phosphoric acid were produced at Samancor's Meyerton plant. All phosphoric acid production was sold locally; about 60% of yellow phosphorus production was exported.

Serpentine.—Production by Samancor from the Honingklip deposit near Krugersdorp in the Transvaal ceased owing to a change in production process by ferroalloy producers, the main consumers. Rehabilitation of the mining area was under way.

Silica.—Quartz was mined near Delmas in the Transvaal by Delmas Silica Co. (Pty.) Ltd., a subsidiary of Samancor, for use in the ferroalloy, building, and refractory industries.

Soda Ash.—All consumption was from imports, mainly from the United States, as there was no domestic mining of soda ash. Research on development of the Sua Pan deposit in Botswana was completed with the assistance of local companies, and construction of a synthetic soda ash plant in southern Cape Province was also considered, but no decision on commencing either project was made by yearend.

Sulfur.—Daily capacity was 70 tons for Mobil Refining Co. of Southern Africa's plant at Durban, 90 tons for National Petroleum Refiners of South Africa's plant at Sasolburg, and 106 tons for Shell and British Petroleum South Africa petroleum refineries plant at Durban.

MINERAL FUELS

At yearend 1986, the latest year for which comprehensive data were available, the country had a total power station capacity of 26,682 megawatts. Twenty stations were coal-fired with a total capacity of 22,912 megawatts, two were hydroelectric with 540 megawatts capacity, three were gas turbine or diesel with 390 megawatts capacity, one was nuclear with 1,840 megawatts capacity, and one was pumped-storage with 1,000 megawatts. The Electricity Supply Commission (Escom) had five coal-fired stations on order with a total installed power rating of 16,347 megawatts, and a pumped-storage station was planned with 400 megawatts installed capacity. Coal consumption in domestic powerplants was 58.9 million tons in

1986, at an average cost of $6.55 per ton. Of total sales of electricity of 117,353 gigawatt-hours, 27.1% was for mining, 33.4% was for industry and commerce, and 3.8% was for traction. Total electricity sales to the mining sector were up 3.3% to 31,860 million kilowatt-hours, of which 71% was for gold and uranium mining, 11% for platinum mining, 6% for coal mining, 4% for copper mining, and 2% for diamond production. Total sales to industry were down slightly to 30,959 million kilowatt-hours, of which 48% was for iron, steel, and base metals; 23% was for chemicals; and 5% was for building, cement, and quarrying. A small quantity of electricity was purchased from outside the Republic of South Africa, and about 4,000 gigawatt-hours was sold to neighboring countries.

Coal.—A process that utilized waste coal in a fluidized bed was successfully developed by the National Institute for Coal Research and was being made available to industry. About 44 million tons of waste coal was produced annually from normal coal-mining operations.

The likelihood of exploitation of coking coal reserves in the protected Kruger National Park were decreased as Iscor successfully utilized noncoking coal to reduce iron ore, and was building a direct-reduction plant for this purpose. Coal producers exporting through Richards Bay experienced increased rail-shipment costs from the South African Transport Services of 20% to 22% at yearend. Rail tariffs were increased about 66% overall in 1987, to $11.60 per ton compared with $6.87 per ton in 1986 for coal from Witbank. The price increases to current coal shippers was reportedly made to more rapidly recover the cost of having expanded port facilities at Richards Bay to 44 million tons per year during phases 1 thru 3. Phase 4, which would allow expansion to 65 million tons of coal exports per year, had been delayed. The export price per ton of coal for March 1987, the last available data, was $30.27 compared with estimated production, shipping, and handling costs of $21.38.

Gencor expected to increase coal production through its Trans-Natal Coal Corp. in order to meet the needs of its expanding oil-from-torbanite project in the eastern Transvaal.

BRL's new Majuba colliery commenced installation of a 64-ton cage having four 16-ton-capacity clamps to act as brakes for safety. The cage had the capacity to move 300 people at up to 3 meters per second in the mine's 320 meter deep shaft. It would also be used for drive-on, drive-off equipment such as continuous miners, engines, shuttle cars and load-haul-dump vehicles.

Petroleum.—In February, the Government approved a $2.7 billion Mossel Bay gas-development project. Located about 85 kilometers offshore of Mossel Bay in 100 meters of water and 3,000 meters below the ocean floor, the F-A area was to be serviced by a single collection-and-conversion platform. The area had 18 wells drilled within a 4.2-kilometer radius. About $150 million was budgeted for engineering and planning work in 1987-88, which included plans for gas and condensate distillation and separation into dry gas and liquid condensate for transport via separate pipelines to an onshore synthetic-fuels plant. Reserves were estimated to last 17 to 19 years, at which time a separate production platform would be erected on the E-M area with pipelines linking the original separation plant.

Energy Resources and Mining Corp., a subsidiary of Johannesburg Mining and Finance Corp., commenced drilling three wells in the vicinity of Kinkelbos near Port Elizabeth. Southern Oil Exploration Corp. (Pty.) Ltd. (Soekor) discovered a small quantity of oil in the area known as Algoa Basin in 1972, and later seismic work by Israeli consultants confirmed the existence of four oil traps. Depth of the traps was estimated at 2,900 meters, and recoverable reserves were about 100 million barrels.

Soekor's offshore drilling rig, Omega, completed refitting and was towed to a new exploration site south of Algoa Bay. Two other rigs were operational, one west of Hondeklip Bay and the other west of the mouth of the Orange River.

Uranium.—Total uranium ore processing capacity was 8,300 tons per year of contained U_3O_8. An additional 2,000 tons per year of uranium capacity was closed owing to low world prices. Capacity to refine uranium to uranium hexafloride was 700 tons of contained uranium per year.

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[1]Physical scientist, Division of International Minerals.

[2]Where necessary, values have been converted from South African rands (R) to U.S. dollars at the rate of R1 = US$0.4408 for 1986 and R1 = US$0.4914 for 1987.

Table 6.—Republic of South Africa: Production of U_3O_8, by producer

(Kilograms)

Company or mine	1983	1984	1985	1986[p]	1987[p]
AAC Joint Metallurgical Scheme[1]	718,928	596,787	602,104	529,811	462,786
Blyvooruitzicht	289,156	233,092			
Buffelsfontein	611,000	613,500	713,500	597,000	446,900
East Rand Gold and Uranium Co. Ltd. (Ergo)	229,885	216,131	150,997	155,780	116,516
Harmony	623,600	496,680	428,300	330,243	178,100
Hartebeestfontein	441,446	436,283	428,367	465,059	415,324
Palabora copper	218,635	156,769	217,828	185,443	176,000
Randfontein	491,067	592,776	609,332	600,498	461,992
St. Helena-Beisa	454,792	353,294			
Vaal Reefs	1,877,421	1,962,977	1,881,828	1,930,044	1,676,817
West Driefontein	174,566	159,638	86,705	81,435	72,971
Western Areas	282,465	305,403	311,836	265,211	205,112
Western Deep Levels	173,841	145,632	54,036		
Miscellaneous	541,190	489,646	268,421	319,745	522,512
Total	7,127,992	6,761,608	5,751,254	5,460,269	4,735,030

[p]Preliminary.

[1]Includes recovery of U_3O_8 from concentrates and tailings produced by the Free State Geduld, Free State Saaiplaas, President Brand, President Steyn, Welkom, and Western Holdings Mines, all subsidiaries of Anglo American Corp. Ltd. in the Orange Free State Province.

Sources: Chamber of Mines of South Africa, Quarterly Analysis of Working Results, Oct.-Dec. 1983-87; Department of Mineral and Energy Affairs, Annual Reports 1983-86; East Rand Gold and Uranium Co. Ltd., Annual and Quarterly reports, 1983-87; Minerals Bureau, Mineral Production and Sales Statistics, 1985, 1986, and 1987; Palabora Mining Co. Ltd., Annual Reports 1983-87.

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